

What's the difference between carbon neutrality, 100% renewable energy, and 24/7 carbon-free energy?

In September 2020, we announced that Google aims to run on [24/7 carbon-free energy by 2030](#). So how does our goal differ from carbon neutrality (a milestone we crossed way back in 2007) or 100% renewable energy ([which we achieved and have maintained since 2017](#))? We thought it might be helpful to explain the three terms, and why targeting 24/7 carbon-free energy is our biggest sustainability moonshot yet.

Carbon Neutral	100% Renewable	24/7 Carbon-free
<i>offsets emissions</i>	<i>reduces emissions</i>	<i>eliminates emissions*</i>
achieved by purchasing carbon offsets that reduce or prevent global emissions	achieved by purchasing enough renewable energy to match annual electricity use	achieved by sourcing clean energy for every location and every hour of operation

Google's progress	Since 2007	Since 2017	By 2030
Helps combat climate change	✓	✓	✓
Encourages full-scale transformation of electric grids	✗	✗	✓
Directly reduces carbon emissions associated with electricity use	✗	✓	✓
Eliminates all carbon emissions associated with electricity use	✗	✗	✓
Matches <i>annual</i> electricity consumption with clean energy	✗	✓	✓
Matches <i>hourly</i> electricity consumption with clean energy	✗	✗	✓
Directly increases amount of clean energy on some electric grids where a company operates	✗	✓	✓
Directly increases amount of clean energy on <i>all</i> electric grids where a company operates	✗	✗	✓

* Google's 24/7 Carbon-Free Energy program aims to eliminate Scope 2 emissions associated with our operational electricity use. For information on how Google is addressing Scope 1 and 3 emissions, please refer to our [2020 Environmental Report](#).

Let's start with **carbon neutral**. The term simply means that a company has purchased enough carbon offsets to compensate for the emissions the company produces through its operations. At Google, [since 2007](#) we have procured high-quality, third-party-verified offsets, including [landfill gas](#) and industrial gas projects that prevent greenhouse gas (GHG) emissions from entering the atmosphere. All our offsets are additional, meaning that the projects reduce GHG emissions that wouldn't be reduced through other incentives. If offsets are high-quality, going carbon neutral is a worthwhile first step a business can take to address its climate impacts. However, offsets generally don't directly reduce an organization's carbon emissions or help transition electric grids to clean energy. When we committed to carbon neutrality, we saw high-quality carbon offsets as an interim solution. As we work to reduce our emissions, our need for offsets will continue to decrease.

Aiming for **100% renewable energy** takes climate action a step further, particularly if it involves direct purchases of renewable energy. At Google, we define the term to mean matching our annual electricity use with purchases of renewable energy like wind and solar. Google pioneered direct renewable energy purchasing when we signed a deal for power from an Iowa wind farm in 2010, and in 2017 we became the first company of our size to [match 100% of our annual electricity use with renewables](#). Today, corporate renewable energy procurement is a [booming field](#) that has helped deploy wind and solar farms to grids around the world, driven down the cost of those technologies, and reduced many companies' carbon emissions.

But we still have more work to do. Even though Google currently buys enough renewable energy to match our annual electricity use, the variable nature of wind and solar means there are times and places where we still have to rely on carbon-based electricity. We currently make up for this by buying a surplus of renewable energy in regions or hours when and where it's abundant. For example, by buying larger amounts of wind energy in places like Europe we compensate for our lack of renewable energy purchases in Asia. And in some places, we buy additional solar energy during the day to balance out our use of carbon-based energy at night. In this way, we purchase enough renewable energy to match our total global annual electricity use – but the reality is that the power we use in some hours and locations still results in carbon emissions.

Hourly carbon-free energy performance at an example data center

While Google buys large amounts of wind and solar power (symbolized by green spikes above), these resources are variable, meaning that our data centers still sometimes rely on carbon-based resources.



Enter **24/7 carbon-free energy** – the final and most challenging step on the road to decarbonizing our electricity footprint. We'll reach our new target when every Google data center and office campus runs on round-the-clock clean electricity. To put it in plainer terms: we aim to shift away from a net-zero model of “emit and compensate” and instead target “absolute zero,” where we simply never emit carbon from our operations in the first place.

To get there, we'll have to work with policymakers, other energy buyers, and utilities to reinvent electric grids. Research shows we'll need a variety of carbon-free energy technologies to quickly and cost-effectively decarbonize the grid, so we'll also consider how we can support a much more diverse portfolio of technologies than we do today.

This is why we're defining our goal in terms of “carbon-free” rather than “renewable” energy. Some of the carbon-free resources we can tap to eliminate Google's emissions are indeed [renewable resources](#), such as wind, solar, geothermal, and sustainable hydroelectric or biomass energy. But we're also working to advance other carbon-free technologies like large-scale battery storage, advanced nuclear, green hydrogen, and carbon capture and sequestration, which can all [help in the fight against climate change](#).

Ultimately, our ambition is to help accelerate progress well beyond Google. By working toward 24/7 carbon-free energy in our operations, we'll help develop the policies, business models, and technologies necessary to decarbonize the world's electric grids. We're proud of the role we played in helping wind and solar go mainstream. Now, even as we continue to deploy those resources at scale, it's time to build out the rest of our carbon-free energy toolkit – and put fossil fuels in the rearview mirror for good.